BEFORE THE STATE OF WASHINGTON

ENERGY FACILITY SITE EVAUATION COUNCIL

In the Matter of Application No. 2003-01: SAGEBRUSH POWER PARTNERS, LLC; KITTITAS VALLEY WIND POWER PROJECT	EXHIBIT 26 (RN-T)

APPLICANT'S PREFILED DIRECT TESTIMONY
WITNESS # 7: RON NIERENBERG

Q Please state your name and business address.

A My name is Ron Nierenberg and my business address is 850 NW View Ridge Court, Camas, WA 98607.

Q What is your present occupation, profession; and what are your duties and responsibilities?

A I am a consulting meteorologist who works for wind energy developers and electric utilities. I provide wind energy meteorological consulting services to organizations such Zilkha Renewable Energy. I assist those organizations in analyzing wind resources such as for the Kittitas Valley Wind Power Project. My duties regarding this Project were to establish a wind monitoring program and analyze the wind data from that set of meteorological test towers,

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including making long term wind speed and energy forecasts. I assisted in the preparation of the Climate Section of the Application for Site Certification.

Q Would you please identify what has been marked for identification as Exhibit 26-1 (RN-1).

A Exhibit 26-1 (RN-1) is a résumé of my educational background and employment experience.

Q Would you summarize your experience with particular attention to the Pacific Northwest.

A I have been working as a meteorologist in wind energy since 1978. As far back as 1980, I worked with a company that had wind farm development sites along the Oregon coast and in the Columbia Gorge. I have worked on several hundred wind projects around the US including several in the Northwest for over 20 years. Last year I acted as a consultant to NREL (U.S. DOE, National Renewable Energy Lab) to review and validate the wind maps they were developing for Washington, Oregon and numerous other western states. I have provided meteorological consulting services to several clients over the past 20 years including various government agencies, utilities, independent developers, financial institutions, lenders and wind power project owners.

Q Are you sponsoring any portion of the "Application for Site Certification", for the Kittitas Valley Wind Power Project?

A Yes. I am sponsoring the following section:

Section 2.1.4 Climate Characteristics

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Clarification Information Attachment 5, 'April 11, 2003 '*Frequency of icing events at proposed windfarm near Ellensburg, WA'* Memo.

Q Are you familiar with this section of the Application and this exhibit?

A Yes

Q Did you provide the information for this section and attachment and assist in its preparation?

A Yes, I was one of several people who provided information for this section.

Q Is the information in this section within your area of authority and /or expertise?

A Yes.

Q Is the content of this section of the Application either based upon your own knowledge, or upon evidence, such as studies and reports as a reasonably prudent persons in your field and expertise are accustomed to rely in the conduct of their affairs?

A Yes.

Q Are there any modifications or corrections to be made to those portions of the Application that you are sponsoring?

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A Yes. The extreme gust, discussed in the last paragraph of section 2.1.4 had been originally estimated at 73 mph based on a study performed in 1981 by Wantx and Sinclair and published in the Journal of Applied Meteorology. Based on more recent analysis of the wind data collected, that peak gust estimate has been modified to 115 mph.

Q To the best of your knowledge, are the contents of this section of the Application with this modification true with the correct information provided above?

A Yes.

Q Do you incorporate the facts and content of this section as part of your testimony?

A Yes.

Q Are you able to answer questions under cross examination regarding this section?

A Yes.

Q Do you sponsor the admission into evidence of this section of the Application?

A Yes.

Q Would you please summarize the information provide in Section 2.1.4 of the Application.

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A The Project site has a semi-arid or steppe climate type. The winds on the site are primarily thermally driven, by the temperature difference between cooler air on the west side of the Cascade Mountains, and hotter air over the Kittitas Valley and over the Columbia Basin and Plateau on the east side of the Cascades. Winter winds are storm driven, but these are less persistent than the spring and summer thermal winds over the Project site. Extreme gust expected in 50 years is 115 mph.

Q Why has the estimate of the peak gust wind speed changed?

A The change to the estimate was based on a re-analysis of the measured peak gust data. Initial analysis showed no gusts above 70 mph and therefore the higher level estimate based on the 1981 study was mentioned in the original ASC. However, upon examination of the 1 second peak values, a 1 second gust wind speed of 103 mph was recorded at the site. It was initially rejected as spurious data for the following reasons: First, the gust occurred at only one out of ten on-site towers. None of the other towers had gusts of that magnitude. Second, 103 mph peak was only measured by one of the five wind speed sensors on the same tower. The other 4 sensors as well as the other surrounding towers showed much lower values at the time of the gust. Sometimes data loggers suffer static discharge or spikes. Due to the surrounding sensors and towers with much lower values, it was originally believed that this was simply an electronic spike. Since the initial analysis, a further screening of the data was performed and we believe that this was not a spike, but may have been a valid data point. Based on this re-analyzed empirical data, it was necessary to re-evaluate the long-term gust estimate, and the result of the evaluation was to increase the estimate to 115 mph as a conservative worst-case estimate.

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Q Does this change in the estimated peak gust speed raise any concerns regarding the physical integrity of the WTG's at the site?

A No. Modern wind turbines are conservatively designed in accordance to IEC standards which require turbines to withstand winds far in excess of 115 mph. It is my understanding that GE and Vestas turbines, for example, are designed to withstand 3 second gusts in the 150 mph range. It should also be noted that a sustained 3 second gust is also generally 2-4 percent lower than a 1 second gust. In order to obtain a peak gust much above the 115 mph peak gust estimate, say in the neighborhood of 125 mph or greater, one of three meteorological conditions must occur. Two of the types of events that could cause a gust of this magnitude never occur at the site, and the third one is very unusual. The first type is a hurricane or tropical cyclone. The site is too far from the ocean for this type of event to happen. The second type of event is an extra-tropical cyclone such as an intense low pressure (winter) storm. While these types of storms occur in the Pacific Northwest with some regularity, their effects are confined to two areas; coastal capes such as Cape Blanco, and high elevations in the Cascades. Cape Blanco does experience winds above 125 mph about every decade, but other coastal sites that are slightly less exposed do not experience these kinds of storms. So, again the proposed Project site is too far from the coast and too low in elevation to experience these type of winds, from an extra-tropical cyclone. The third type of weather system that could cause 125 mph winds is a tornado and these are an extremely rare phenomenon in the Kittitas Valley and cover a relatively small area if they do occur.

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To conclude, we note that we have experienced a one second gust (at one level, at one site) of 103 mph. We are not in an area that has the meteorological mechanisms to cause extremely high gusts on the order of 125 mph. And the statistical approach, using standard Weibull distributions produces a result of 115 mph, which I believe is a reasonable estimate for a 3-second gust.

Q Would you please summarize the information provided Attachment 5 of the Clarification Information, April 11, 2003 Memo '*Frequency of icing events at proposed windfarm near Ellensburg, WA'*.

A In order to estimate the frequency of icing events at the Kittitas Valley Wind Power Project site, I obtained meteorological records from the Ellensburg Airport. There are about six years of reliable records from the airport. During this 6-year period there was an average of three days per year of freezing rain. Freezing rain is the condition that could cause icing on the wind turbine blades, so it is the most relevant weather event. Because the elevation of the proposed site is about 500-ft to 1000-ft higher than the airport, I would estimate that icing events would occur slightly more frequently than at the airport. Therefore, I would estimate that there could be approximately four to five days per year where ice might accumulate on the turbine blades.

Q Could you describe how the wind resource at the proposed site compares to other sites in Washington?

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A Over the past 20 years, I have evaluated and examined wind data from more than 500 meteorological towers from various potential wind power project sites in the Northwest. Based on my experience, there are truly very few sites that have what it takes to work for large scale wind power projects in the state of Washington. In order to be economically viable, a site must have a strong wind resource, available and adequate transmission, and good accessibility. The Kittitas Valley site is one of the best wind power project sites available in Washington. The wind resource is comparable to those at the large Stateline Wind Project near Walla Walla and the Nine Canyon Project near the Pasco. Subtle differences in wind speed have a profound effect on the amount of wind energy that can be generated. This is because wind power varies with the cube of the wind speed. Therefore a wind speed that is twice as fast in the same area will carry 8 times the amount of energy. For this reason, a difference of a few mph in the average long term wind speed can mean a difference of 30% in wind energy and this is easily the difference between a site that works versus a site that does not work for a wind power project. Generally to be economically viable in today's energy market, a site must have an average wind speed of at least 16 mph. A site with a wind speed of 15 mph probably is not a viable site. The only other undeveloped economical wind farm sites that I am aware of, with a comparable resource in Washington are the Wild Horse Project near Whiskey Dick Mountain, and the Columbia Hills, near Goldendale. Other sites may exist, but have not been measured and assessed adequately. Based on my experience in prospecting the state of Washington for other potential wind sites, I estimate that there are fewer than 6 other economically viable and developable sites for a wind power project larger than 50 MW. There are also some other sites that exist but are not

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developable, such as in the "Scenic Gorge Area" or at Cape Flattery, which I understand is constrained by limited local transmission capacity.

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Exhibit 26-1(RN-1)

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OBJECTIVE

Design, implement, manage and analyze wind energy assessment programs to optimize production from windfarm developments.

QUALIFICATIONS

* 25+ years experience as wind energy meteorologist.
* Sited/assessed 1,000 MW of wind farms in both 2001 + 2003, ~2/3 of U.S. installations.
* Managed wind monitoring programs with aggregate value of $3 million.
* Conceived and managed two DOE funded wind research projects.
* Developed software library for wind energy analysis.
* Conducted original wind study of the Altamont Pass.

ACHIEVEMENTS

Designed and managed large federally funded wind turbine study. Analyzed energy production test data to determine causes of variability in turbine performance. Resulted in authorship of two DOE/NREL (SERI) reports. Achieved 99.9% data recovery rate.

Consolidated and analyzed wind data from entire Altamont Pass to explain multi-million dollar revenue losses due to macro-scale wake effects. Findings published in five journals.

Developed extensive software library, used exclusively for wind energy analysis, which can run on mainframes or advanced PCs.

Co-authored original wind resource assessment study of the Altamont Pass, published by California Energy Commission, which led to the installation of $1 billion of wind turbines.

Designed and managed hundreds of wind monitoring programs for windfarm developments in California, and other states, as well as Canada, Latin America, China, India and the UK, to accurately assess economic viability of these projects.

EXPERIENCE

Consulting Meteorologist,	DOE, FPLE, and other utilities, and every major U.S. wind developer	1982-Present
Meteorologist,	Howden Wind Parks Inc.	1986-1989
Director of Meteorology,	NFC Energy Corp.	1983-1984
Chief Meteorologist,	Windfarms, Ltd.	1981-1982
Meteorologist,	Pacific Gas & Electric Co.	1978-1981
Meteorologist,	Oceanroutes	1977-1978
Researcher,	National Center for Earthquake Research	1975-1976

EDUCATION

B.S.	Meteorology, California State University, San Jose	1976
B.A.	Geography, California State University, San Francisco	1971

PUBLICATIONS

R. Nierenberg, Wake Deficit Measurements on the Jess and Souza Ranches, Altamont Pass, U.S. Department of Energy/SERI, April, 1990.

R. Nierenberg, Free-Flow Variability on the Jess and Souza Ranches, Altamont Pass, U.S. Department of Energy/SERI, March, 1989.

R. Nierenberg, Macro-Scale Wake Effects, American Wind Energy Association, September, 1989. Portions of this paper appeared in *Wind Power Monthly, Independent Energy, WindStats Newsletter* and *European Wind Energy Conference and Exhibition, July, 1989.*

R. Nierenberg, An Innovative Wind Measurement Program Using Fixed, Mobile and Kite Anemometers, American Wind Energy Association, October, 1983.

Davis, E. and R. Nierenberg, Wind Energy Prospecting in Alameda and Solano Counties, California Energy Commission, May, 1980.

AWARDS

Special award “For making critical contributions to the development of wind energy in the U.S. and around the world”, presented by the American Wind Energy Association, April 1998.